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SOME USERS WANT THEIR OWN COMPUTERS

Computer usage in companies is changing. Last year we discussed how some users want to do their own 'programming.' Now a growing number of users want their own computers. The lower costs of minis and micros permit computers to be installed in departments and on desk tops. So 'end user computers' are appearing outside of traditional data processing environments. In this report we look at why some users want their own computers and how information systems departments are coping with this trend. Next month we look at why some information systems departments are themselves using minis and micros.

Westinghouse Electric Corporation, with headquarters in Pittsburgh, Pennsylvania, is the 34th largest industrial corporation in the U.S. according to *Fortune* magazine. With sales of over $9.3 billion, Westinghouse manufactures a large variety of industrial products, ranging from large electrical generating equipment to sophisticated defense systems.

The standard control division of Westinghouse, located in Beaver, Pennsylvania, manufactures and sells industrial controls, mainly motor controls. Previously, three regional sales managers in the division received five-inch thick computer-generated reports each month from the corporate computer center. These reports gave detailed sales information, and it often took these managers several days to find all of the specific figures they were interested in seeing.

As Schindler describes in Reference 1, the reports are now generated in the division on a micro-computer—an Ohio Scientific OSI C28P with 48K bytes of memory, dual 8-inch floppy disk drives, and a Centronics 779 printer.

The conversion project began when the marketing manager thought the idea of a local micro-computer sounded worthwhile—if it would indeed speed up the reporting process. Since no one had a computer background, the training manager was selected to decide whether a micro could perform the job. He had two concerns.

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One was: Would bringing in this computer also require hiring several people for collecting and entering the data? Secondly, would a computer expert be required to set up and run the system? If any additional employees were needed, the project probably would be uneconomical.

The manager began by analyzing a survey of micro-computers. Based on the survey, he chose the Ohio Scientific computer because of the database management software available with it. After some experimentation, he decided that it was a reasonably friendly machine and it could indeed produce the needed reports. Creating the reports would be made easier by the report generator and database management system. In addition, he concluded that there would be no need to hire a computer expert to create the software.

The manager also proposed to solve the data entry problem by getting data directly from the corporate data center, through a communication link to the central IBM 370 computers. However, that step would require converting the center's data from IBM's EBCDIC code to the micro's ASCII code and converting the IBM bi-synchronous transmission protocol to the micro's asynchronous protocol. These problems were largely solved by a protocol conversion product from Expander Inc. of Pittsburgh. This product, called The Black Box, allows the micro to emulate an IBM 2780 card reader and communicate with the mainframe at 2400 bps. The manager is currently investigating a more recent product—a circuit card that can be inserted in the microcomputer which emulates several IBM terminal types. This product is being developed by International Automation of New Kensington, Pennsylvania.

A number of other minor, yet important, changes were also needed. These were performed by the local OSI dealer. One problem involved expanding the micro's buffer to accept the 2780's 80-character line width.

At the data processing center, the reports are run as if they are to be printed, and then put into a print queue. A division secretary then calls the data center, and transfers the report files from the IBM system to the micro. She stores these files under the database management system and then uses menu-driven programs, written using the report generator, to create these reports.

Due to the success of this project, micros are now communicating with the data center for other applications. For example, an OSI micro is being used to obtain information about non-stock modified products—information previously inaccessible to the product managers. And that micro is also being used to track field warehouse information.

Mountain Bell

Mountain Bell Telephone Company is currently one of the 21 operating companies within the Bell System (although divestiture of the operating companies is expected to occur next year). The company provides telephone service to some 4.5 million customers in the Rocky Mountain states of the U.S.—Colorado, Wyoming, Montana, Utah, Idaho, Arizona, and New Mexico.

In 1981 Mountain Bell began installing an interesting application on departmental mini-computers. Until early last year, when an employee had a problem with a company-owned vehicle, he or she would take the vehicle to a company mechanic for repair. This 'manual system' of scheduling maintenance left much to be desired, because there was no central control. Management had no way of tracking the repair workload and balancing it among the garages and mechanics. Some repair orders were not performed on time, and repair mechanics often either had too much work or not enough.

So the department decided to look into centralizing the repair control operation for their some 12,000 vehicles and 2,000 special tools. They wanted a computerized system that would allow an employee who needed a vehicle repair to be able to call a central telephone number. The answering operator would call up the vehicle's record from a data file and enter the repair order. From these repair order entries, the system would then create repair schedules for the Mountain Bell mechanics. At the beginning of their work shifts, the mechanics would dial into

the system, using a remote terminal, to receive their work assignments.

For such a system to work, the department felt they could not use the time-sharing option offered by the Mountain Bell information systems services (ISS) department, because it would only support dial-up lines, which would provide too slow a response time for the repair operators. So the department began looking for a departmental computer that they could dedicate to their repair operations.

With the help of a system analyst from the ISS department, the automotive operations department manager and the district manager wrote the system requirements. After evaluating several mini-computer options, they chose a popular mini-computer, with 11 CRT terminals and one printer directly connected to the computer, plus 21 remote printer terminals for field use connected via dial-up lines. The system cost $54,000 and would allow the division to keep track of 6000 vehicles and 1000 special tools within the northern region, with operations centered in Denver, Colorado. A similar system would also be needed for the southern region, with operations centered in Phoenix, Arizona.

Mountain Bell chose this system because of an operating system and data management system available from a Denver software firm. It is a multi-user, interactive operating system with a database management system and data management facilities, including a user-friendly query language, a data dictionary, and a PL/1-like programming language. Mountain Bell contracted with the software firm for the hardware, the operating system, and the needed application programs, because the automotive operations department had no desire to hire a programmer.

Interestingly, the data for the system already existed in a motor vehicle information system, created by AT&T, and used by Mountain Bell to track vehicle costs. So the automotive department decided to off-load that database, and use it 'as is.'

Originally the system was to handle vehicle maintenance only, but it has since grown to include parts inventory control, vendor invoice tracking, and employee records management. With this growth, the department has upgraded the hardware to a larger mini-computer.

The original repair control system, which contains some 6000 lines of code, took six weeks to create. This portion of the system was installed in the Denver center in early 1981. The other portions were developed sequentially and installed one by one. In total, the system now contains some 18,000 lines of code. The various districts in the northern region were brought on-line during the remainder of 1981 and part of this year. Late last year, the southern regional center was established in Phoenix and its districts are being put on-line through this year.

Users—management, operators, mechanics, and foremen—need only brief on-the-job training to use the system. For example, managers are given six hours of training to teach them to use the query language to formulate their own ad-hoc queries.

The department is pleased with its two new regional computers. The software is maintained by the software house, the hardware is maintained by the hardware manufacturer, and the department has not needed to add any data processing personnel to operate the system. In fact, the system has already identified where there is not enough maintenance work, so the department is gradually reducing its vehicle maintenance work force through attrition. The department managed this data processing project on its own except for three aspects—a system analyst from the ISS department helped write the system requirements, people from the operations department within ISS handled the hardware contracting, and the data was extracted from an existing ISS database. In all, the automotive operations department is most happy with the way its own computers have worked out.

Minnesota Educational Computing Consortium

The Minnesota Educational Computing Consortium (MECC) was founded in 1973 to oversee the acquisition of computers by Minnesota school districts. The state has 437 school districts, of which 80% are small, having fewer than 1000 students and 60 staff members each.

In the past few years MECC's role has expanded to include providing computer expertise to the districts on both the instructional and administrative uses of computers. And in 1978 MECC negotiated a state-wide contract with Apple Computer whereby schools could purchase Apple computer systems for instructional purposes at a discount. Over 2300 Apples have been purchased by secondary schools through this plan.

In 1979 MECC, through the urging of the school districts, began investigating the possibility of using the Apple computers for administrative purposes, reports Stamps (Reference 2a). The school districts had been using a standard financial system that was run at various regional data centers. Most of the districts had been mailing their financial data to the data centers on computer forms, which were filled out by hand.

The school districts wanted more timely reports. Under the manual system, they had to close their financial books one week before the end of each month, in order to get their data to the center on time. Transactions received in the remaining week of each month were posted a month later. This lag time of one month caused numerous difficulties. Also, delivery of the financial statements back to the school districts often took several weeks.

The most economical computerized alternative at the time was to use a terminal to enter transactions to the main computer, using the telephone lines. But for the many small districts, the costs would be too high for them to consider this alternative.

Since many of the secondary schools already had Apples, and since many of the school districts only needed to use a small computer for a short time each month, the districts could 'borrow' time on the students' computers to enter and send their financial data. The idea sounded promising, so MECC investigated to find out what kinds of software they would need to provide.

MECC found they needed to create two kinds of custom software. One type was communication protocol conversion software, so that the Apple and Burroughs machines could 'talk' to each other. These programs were written in assembly language for the Apples, and in Algol for the Burroughs mainframes.

The second type was report generation software, for the school districts to use. This was written in BASIC. Also, many districts have people knowledgeable in BASIC, and these people can write special report programs to suit any unique needs.

In total, MECC spent about nine work-months on the project—most of that time was spent figuring out the protocol conversion requirements.

The new system was installed early last year. By using it, the districts are now able to close their financial books on the last day of each month. Also, entering the data takes less time than it did with the manual method. Further, districts that have a printer tied to their Apple can obtain interim reports on-line.

MECC is in the process of installing a standard payroll package and student records package for the school districts to use. Once again, the Apples can be used for data entry and reporting. So use of the micros by the school districts is expected to grow.

Why end user computers are appearing

These three cases have one point in common. They involve data processing applications that have been put on end user computers. But in each case, the end user system *supplements* the main data processing systems, to give the users certain improved services. Nothing of any consequence was taken away from the central data processing departments.

There are numerous reasons why end users are asking for their own computers. The reasons most often cited are: (1) the decreasing cost of computers, (2) the growing number of user-friendly packages and data management systems that run on end user computers, and (3) some dissatisfaction with the information systems department's response to their individual requests for 'small' programs or 'quick' changes. A more subtle, yet equally important, reason is the general public's growing familiarity with computers.

The growing familiarity with computers. Computer terms are being heard with increasing frequency in our daily lives. Automobiles have

'computerized' dashboards, video tape machines can be 'programmed' days in advance to record television shows, clocks and stereo recorders are 'digital,' 'memory' is available on 'electronic' typewriters, and 'computerized' games are entrancing (and some say entrapping) our youngsters.

Until recently, an explanation that began, "The computer says ... " was accepted by non-data processing personnel as an overture to jargon that they could not understand. But these same people's familiarity with computers has expanded tremendously in just the past couple of years. Ordinary people now can confidently control their video game systems without first attending a computer course, or use call-conferencing or call-forwarding on their telephones without being trained in an 'operation control language.' Secretaries willingly upgrade to sophisticated electronic typewriters with storage, switches, and more functions than they ever had available before. Retail store clerks use point-of-sale registers to complete 'simple' transactions that actually can affect many records (inventory, accounts receivable, and even payroll). The skill level necessary to operate a terminal nowdays is no longer high.

And these 'hands on' experiences with computers are not limited to just our working lives. Today, we can walk up to an automatic teller terminal during most hours of the day or night, key in a password, give input/output instructions, and have it issue us cold, hard cash. What began as a natural reluctance for the common citizen to become involved with indifferent, electronic computers is rapidly disappearing.

Most everyone growing up these days expects to drive an automobile. It does not matter that the car is a complex piece of machinery. What matters is that most people are able to handle it; therefore, few are afraid to try. Computers are moving toward that degree of familiarity. And more non-data processing personnel are willing to consider using a computer to solve their special kinds of business problems.

In addition, articles are beginning to appear in leading business magazines (such as *Business Week*, *Fortune* and *Forbes*) that discuss the use of terminals and personal business computers, and with the tone of: "This is now the thing to do." For instance, an article appearing in the March 29, 1982 issue of *Business Week* is titled: "How to conquer fear of computers" and is aimed at managers. Where executives and managers once looked down their noses at these 'keyboard devices,' personal computers are now beginning to take on the aura of status symbols.

Where end user computers are appearing

We have observed three types of situations where end user computers are being installed: (1) for individual use, (2) for communicating with others, and (3) for departmental (shared) use. Generally, these are not situations that currently are being served by existing corporate computer centers. In fact, we have not as yet come across any instance where work was being off-loaded from an in-house mainframe computer (except input validation and output printing, such as at Westinghouse). It would appear that this is because most applications already on mainframes are best suited for the types of processing that mainframes do well. The smaller machines are being chosen for other types of needs.

For individual use. More and more executives, managers, and professional staff members are looking at personal business computers as tools they can use to experiment with their ideas. The computers can perform the tedious calculations or turn the numbers into graphics, while the users can try out different what-if situations. They see them as decision support aids, as we discussed in the March issue.

These same users also see these small machines as 'private.' They can be used in a private place, such as one's home, or in the privacy of one's office, and there is no electronic record of their use. Learning can proceed at one's own pace. And sensitive information can be kept on a floppy disk, which can be locked up when not in use, away from electronic access.

In addition, these employees find that they can get quick access to some very valuable information through on-line database services if they can operate a computer or computer terminal. And there are software packages that perform the

data manipulation, so they do not need to learn to do much of their own programming. And even where they do need to create their own programs, these can be written with a very limited subset of a language such as BASIC, as we also discussed in the March issue.

Executives and managers have tended to resist having their own terminals—often because they do not type well and/or because a keyboard terminal may give the impression of a clerical job. But technology is changing that image, in the form of the Grid managerial work-station and the Xerox Star system (both discussed later, in the Commentary section). In addition, the marketplace is offering more and more application software, aimed at managers and executives, and designed to run on micro-computer work-stations. This end user market will find it increasingly difficult to resist using this technology; it just has too much to offer at too attractive a price.

For communicating with others. The ability to communicate with other people electronically will become an increasingly important reason for installing networks of small machines. For instance, in the personal and hobbyist computer field, electronic 'bulletin boards,' where people can leave messages for one another, have become an important part of that culture. Another feature of some networks is the 'chat' facility where two users—who can be on different continents—can carry on a two-way message dialog. Based on such experiences at numerous locations, we would expect to see communication functions such as these become important uses for personal business computers.

For departmental use. Mini-computers and multi-user micro-computers are being installed to serve a limited number of users in (say) one department. From the cases we have observed, this has occurred for specific applications that data processing cannot provide or provide soon enough. In short, they are being used to supplement the services of the information services department.

Some of these minis have very powerful data management systems, with which new applications can be developed quite rapidly (as was the case with Mountain Bell, described above, and as we discussed in our May through September 1981 issues).

In addition to data management systems, many are providing high quality office automation functions. So, almost as an 'extra,' department managers can get facilities for automated calendars, computer messaging, word processing, and electronic files.

The new 16-bit 'personal' micros (such as those employing the Intel 8086/8088, Motorola MC68000, or Zilog Z8000 processors) are actually suitable for multi-user use. Currently, some of these new offerings will support two or three 'slave' terminals. We would expect to see this capability expanded to (say) 8 or perhaps more terminals. Multi-user machines such as these probably will move into small work groups, to support their specific needs.

The characteristics of data processing work that is being put on the departmental computers seems to be as follows. It is work that is limited to the interests of the one department, using data that the department generates. Also, it often is work that requires fast response, of a type that may be expensive or inconvenient for the main computers to provide (due to the particular operating system used, the existing workload, or other such reasons). Or the work may require a large amount of computing resources, as is the case with the use of color graphics (as we discussed in our February issue). Or the departmental computer may be desired in order to move ahead with office automation, which might be done more quickly with the departmental computer than trying to put it on a mainframe.

Also, what generally happens when these multi-user computers are installed, we have observed, is that a lot of applications suddenly appear that were not even mentioned in the justification for the computer, because it is so convenient to put them on a departmental computer. Many of these are of the 'nickel and dime' variety that the data processing department would just as soon not deal with—but the end users consider them important.

Are end user computers inevitable?

With all of these arguments in favor of end user computers, one might ask whether they are inevitable? Many people seem to feel that they are. But a few information systems managers believe that they are not the best solution to the computing needs of users. Here are their arguments against end user computers (and in favor of in-house time-sharing services).

Although small computers are easy to use, eventually those computers will require some level of computer management. In particular, shared use of a computer makes management issues much more evident, and probably inevitable. For example, someone will need to handle the supplies, implement the program and operating system updates, and understand licensing and trial use agreements. Also, someone should be responsible for managing the shared data, for making backup copies of the shared data, for monitoring system use to estimate capacity limitations, and for planning for additional capacity. Finally, someone will need to know what to do when the system fails—how to investigate the problem and get it solved.

Users do not see these 'hidden' computer management problems, say the critics of end user computers. They only see the running of their applications—but there is more to operating a computer than just running applications. The end result will be that end users' own computers will lead to lots of little 'computer departments' within a company and much duplicated 'computer management' effort. So say the critics.

In-house time-sharing service can provide equivalent or better service than users can get on small machines, they also argue. For example, users can have much larger memory and storage areas. Also, the users are not burdened with maintaining the hardware, software, databases, and so on. Economies of scale are still pertinent, they say, and it is easier to allow employees to communicate with each other using one or several large machines rather than trying to inter-connect numerous small machines which are probably incompatible and which are controlled by different people.

Further, data can be used for multiple purposes on a central time-sharing system, which is not true if the data is stored on separate machines 'owned' by different employees or departments.

For applications where there is no equivalent software for the large machines, information systems can install a small computer with the appropriate package and allow users to access that computer through the time-sharing network; time-sharing does not mean using only large machines.

So giving users a terminal and access to services under the control of one authority—the information systems department—is still best for the organization, they argue.

Other information systems managers are not quite so adamant in their criticism of end user computers. But they do have concerns about the trend and how to guide it in their organizations' best interests, which we will discuss shortly.

Are end user computers inevitable? Even with these cogent 'con' arguments, we suspect that they are! The personal business computers already on the market are quite powerful and relatively inexpensive. The 16-bit machines that are arriving in the marketplace are even more impressive. Machines that use the Zilog Z8000 processor can have from 256k to 1 megabyte of memory (soon to be increased to 4 megabytes, we hear), while those that use the Motorola MC68000 will shortly be able to have 4 megabytes of memory—and, within a year or two, *up to 16 megabytes*! So the small computers are getting almost to mainframe power levels.

But, in addition to this power, their prices are quite low. The result is that there is a growing body of users who are buying them and who want application software. To meet this demand, individual programmers and small software firms are stepping into the breech. They, too, can afford to buy these computers for developing software. So they develop and market attractive software at quite low prices—say, $300 to $500 for a package. Based on the success of the VisiCalc electronic worksheet, these people are going after the managerial and professional markets. There will be a growing body of decision support packages, graphics packages, and other

software aimed at this body of users. And to be competitive, these packages must be both powerful and easy to use.

Why do end user computers appear to be inevitable? Because no data processing department can hope to keep up with the wide variety of good application software that is already available for the small computers—and more is arriving every week. We have purchased and used some of these packages and we can attest to their usefulness and friendliness. There is just no comparison in friendliness between good packages on small machines and some of those offered on a national time-sharing basis that we have used. It will be very difficult for centalized on-line systems to keep up with this competition *across the board.* And where they cannot keep up, end user computers will be brought in.

Major concerns about end user computers

Even if end users do get their own computers, many information systems executives have reservations about this trend. Following are some concerns that we have heard voiced.

Threat to integrity of corporate data. Presumably, organizations that have end users with computer terminals accessing corporate computers already are employing security features, password-protected files, audit trail software, and so on. Users can already access corporate data on their own; if there is a risk that they will change data, that risk already exists.

The most likely uses of personal business computers will be to *extract* data from corporate files, store it on the micro, and manipulate it locally. As far as safeguarding the integrity of the data from a personal computer user, this really does not differ from a computer terminal user. All of the companies that we have talked with or heard about *do* restrict users to only extracting data from corporate computers. Users cannot input new data or change existing corporate data, as a matter of corporate policy. Any violations of this policy that are detected can result in disciplinary action.

Files that individual end users create will probably be 'personal files'—files that other people do not really have a need (or a right?) to see or use. These files probably will include drafts of memos and reports, personal programs for analyzing data, plans still in the formative stage, and so on. These files will be the user's responsibility, not corporate information systems' responsibility.

For the departmental minis, there is more chance that the data that is entered onto those computers might be of use to others within the corporation. Now the question of integrity does arise—should information systems allow that data to be put onto a corporate computer so that it can be used by others? The answer that we have heard so far is *No.* Information systems departments do not want to become responsible for the integrity of data over which they have no control. Employees who want access to data on the departmental machines presumably must talk to those departments directly, not to the information systems department.

Data security and privacy considerations. It appears that in some ways, personal business computers are more secure than corporate computers. Users can lock up floppy disks that contain sensitive information. And knowing that there is only one copy of the data, and it cannot be accessed by anyone else *electronically,* may make employees, particularly executives and managers, feel that their end user systems are more secure than the corporate computers.

Security becomes a concern on multi-user systems. The small multi-user systems do not have the same quality of data security features as the larger machines—so this is a legitimate concern. The problem exists whenever there is data on (say) a hard disk unit which is shared among multiple users.

The privacy issue is a problem on any type of system, because it deals with the *type* of information that is being stored. On small systems, how can the data administrator know whether 'illegal' personal data files are being created? The answer is: He/she probably cannot know. So one approach is to tell employees about the types of data that are illegal to compile and store, and why. Then the employees are responsible for their actions. Violations might be detected by surprise audits.

Standardization. It is presumably better to have computers that can 'talk' to one another, because networks of computers will allow employees to exchange messages and information with one another without having to log on to more than one computer. With this thought in mind, most information system executives feel they need to establish standards so that, when desired, the computers can be more easily connected to one another in the future.

Yet standardization is a big problem, especially in the fast-changing micro-computer field. Just in the last year or so, the 16-bit personal business computers began to arrive on the markektplace in quantity, bringing with them many attractive new features. And yet companies are still recommending that their employees 'standardize' on the less powerful 8-bit computers. Obviously, no one computer or even one manufacturer's line of small computers will satisfy every employee in an organization. It appears that standardization on specific hardware is short-sighted.

More appropriate and longer term standards appear to be in the data communication, programming languages, and operating system areas. We will discuss this point shortly.

Additional workload for information systems. Many information systems executives fear that end user computing will increase, not decrease, their department's workload. For instance, end user information centers are a new phenomenon (as we discussed in the May and June 1981 issues) and there is precious little data on whether they increase or reduce information systems' workload.

Initially, it seems unanimous that the introduction of an information center, where end users get hands-on use of a larger computer, decreases the backlog of work for conventional data processing. Generally, the employees take on the work of designing their own reports and extracting data—work which they formerly would have requested from data processing. As long as users perform their own 'programming' and maintain their own systems, it is possible that the workloads in information systems will not increase because of the end user computing trend. On the other hand, their use of the computer may only whet the appetites of end users for more new services from data processing. So the jury is still out on this workload question.

The introduction of micro-computers appears to be different from the use of information centers. People use them to replace manual work in many cases. And since many companies do not yet let end user computers communicate with corporate computers, off-loading the reporting and query workload from information systems has not yet been widely achieved.

Finally there is the question of whether the information center needs a large staff of computer experts. From all that we have seen, support groups are very small. Initially, users need training and personal guidance. But after some weeks, they work mostly on their own. At IBM Canada, for example, they were able to support over 800 users with a support staff of eleven people, as we described in our June 1981 issue; you do not find leverage like that very often.

These then are concerns that information systems managers have about the burgeoning number of departmental and personal business computers appearing in their organizations. Now we turn to the solutions some companies are taking, mainly with respect to the personal business computers which are easier to 'sneak' into an organization.

Living with end user computers

There are a number of programs and policies that information systems departments are implementing to cope with, and guide the acquisition and use of, end user computers. However, none of the organizations we know of have taken all of the following actions.

Round table groups. As Fioravante describes in Reference 2b, information systems executives from nine companies in and around Westchester County, New York have formed a micro-computer users group to exchange ideas on how to best guide the end user computer trend in their companies. They meet quarterly and are in the process of establishing formal policies regarding micros within each of their organizations.

We have seen the round table approach used widely in other areas for over 20 years—whenever the need has arisen, such as when comput-

ers were first being installed for business use, for office automation, and so on. For a more detailed discussion of round tables, as used in office automation, see our February 1980 issue. The principles of establishing and fostering the growth of round tables are basically the same in any area.

Controlling purchases. Many companies are now grappling with the question of how to control the acquisition of end user computers, particularly personal business computers. We know of a number of information system departments that have created formal policies on choosing and acquiring these small computers. In most cases, the user must submit a formal request, describe the intended use of the computer, and estimate expected benefits and cost savings. In return for following these procedures, these data processing departments handle the requests as soon as possible and also offer several acquisition and maintenance services to the user.

Generally, the information systems department recommends specific hardware and software packages in order to standardize on certain hardware, to ease future integration. Yet, as we mentioned earlier, we believe that standardizing on hardware will be very difficult, because the micro-computer field is changing so rapidly. It is nearly impossible to predict what new products will be available even in the near future. A personal business computer that looks adequate today may appear 'obsolete' in six months to a manager or professional staff member who finds that a new system offers features he/she has been eagerly seeking.

We do know of several companies that have chosen to standardize on one programming language—UCSD PASCAL. We discussed the subject of portability of languages on small machines in our December 1981 issue. In the case of UCSD PASCAL, the entire software system—including the operating system, compiler, application programs, and utilities—can be moved to another computer if the intermediate 'p-code' run package exists for that machine. P-code systems do exist for a large number of micro-computers, or they can be written in a couple of months' time for other computers.

Information systems should also be looking toward data communications standards for computer-to-computer communications and file transfer. Today, most micro-computers communicate with host computers by acting like a terminal and using a terminal-to-computer communication protocol. Some also provide a low speed (300 bps) asynchronous file transfer capability. These solutions will not suffice for the future; that is one reason why local area networks will be important.

Yet another type of standard is operating systems. The CP/M operating system is a recognized de facto standard for single user 8-bit and 16-bit micro-computers. In the multi-user world, several operating systems are vying to become 'the standard.' These include: UNIX from Western Electric, MP/M from Digital Research in Pacific Grove, California, and OASIS from Phase One Systems, Inc. of Oakland, California.

By choosing a 'standard' operating system, the user will get access to a large and growing body of application software. Also, migration to new machines will be eased if they too use a version of this operating system.

In addition to recommending some type of 'standard' system, the information systems department may act as the central purchasing agent for the users, in order to gain more favorable prices, maintenance contracts, and such. Sometimes the computer is bought under a company overhead account. In other companies it is bought out of the information systems department's account. And in still other companies the user is expected to pay for it out of his/her department's budget.

Yet another approach is for companies to subsidize purchases of personal computers by offering interest-free loans to employees. One company we know about does not care what type of personal computer the employee chooses; it just wants its employees to become more familiar with computers. In such cases, the company might expect these computers would be used at home. The chances are, though, that some will show up at work.

Support centers. If you are a regular reader of the *EDP Analyzer*, after you have read this section, you may find yourself saying, "That sounds

awfully familiar; I have read much of it before." And you will be right. Several major new trends in computing—end user computing, office automation, and micros in companies—involve pushing computing out to the end user. And a major part of the information systems department's role in these trends is providing *end user support.*

Within the past two years we have begun to hear about several types of 'support centers'—IBM's information center concept, 'micro centers' to be discussed shortly, and even office automation training centers. The concepts are basically the same—to provide the staff, tools, and training for end user computing. Yet the centers vary in their emphasis.

It is possible that all of these support centers will eventually be pulled together to form a new section or department within a company, possibly within the information systems division. In fact, this is starting to happen in a couple of companies. So while the following discussion is aimed at the introduction of personal business computers, its concepts are more widely applicable. We suspect that many of the larger organizations will have begun to establish one or more types of support centers by the end of this year.

What is a support center? It is a (currently) small portion of an information systems department's resources set aside for the express purpose of helping end users perform their own computing. Since the concept is new, most companies are learning by doing. And in the microcomputer area, the newest idea is to establish a micro center.

Micro centers. One exciting action that information systems departments are taking is to establish 'micro centers.' A micro center is a place where an end user can go to try out a personal business computer. The most well-publicized (and perhaps first) micro center was established at American Can Company. As described by Fioravante (Reference 2c), American Can began with one Apple computer and two software packages, VisiCalc and Apple Plot (a business graphics package), in their micro center. Two staff members demonstrate how to use the computer and the packages in 1-1/2 hours time. If there are five or fewer participants, they all sit around the Apple computer for the demonstration. For more than five, they hook the Apple to a large television screen.

The MIS department advertised the existence of this micro center in their company newspaper and they were 'swamped' with interested employees. The company is enlarging the center by adding more computers and several other decision support type packages. After employees see the demonstration, and try out one or more of the packages on their own problem, they generally go out and buy a personal business computer, rather than reserve time at the micro center.

At another company we know, they are expanding their information center, which they established last year, to include a micro center. Users have the choice of accessing a large minicomputer from terminals, or going to the micro center to use the personal business computers. Still another company is allowing users to access either a mini-computer or their choice of several popular micro-computers from their terminals.

Training courses for end users are starting to appear. As Zientara reports (Reference 3), Westinghouse Electric Corporation is setting up training courses about micros for executives and managers. Their first two, both entitled "Management applications of personal computers" are two-day courses and were given to 91 managers in the first month they were offered. The education department expects to present these courses some 20 times this year to over 400 employees.

Each class has about 20 participants who work in pairs on a computer. One of the courses demonstrates how to use the Apple II+ computer; the other concentrates on using Radio Shack TRS-80 computers. Westinghouse is planning one more course using either Hewlett-Packard or IBM personal computers. And they expect to offer similar courses to their professional and clerical employees soon, reports Zientara.

Even more unusual, the education department presented a half-day hands-on tutorial on personal business computers to the corporation's management committee, including the vice-

chairman of the board and four company presidents.

Assistance hotlines are also being established in companies to provide end users with assistance whenever they need it. Generally, a user can call the number anytime during the working day and talk to a support center staff member; together they solve the user's immediate 'programming' problem either on the telephone or by meeting together.

Experience sharing. Companies are using several means to promote the sharing of (1) programs developed by end users, (2) knowledge acquired by end users and data processing staff members, and (3) tips on 'good computing practices.' Some companies publish an end user computing newsletter, and mail it to any employee who is interested in reading it. Others have informally designated certain employees as 'the experts' on specific types of machines or software products.

Training staff members. One of the crucial elements of a support center is a knowledgeable staff. Obtaining a knowledgeable staff can be a problem. Employees who are knowledgeable about micro- or mini-based products *and* who like to deal directly with end users may not be easy to find. Fortunately, in most cases, a support center only needs one or two employees to get it going. These employees draw other company professionals into the project as needed—for example, for creating the training sessions and evaluating products.

Custom programming. Generally, information systems departments with support center staffs firmly refuse to allow these people to perform any programming for the end users. Their job is only to provide assistance. However, in a few cases, we have seen information systems provide some custom programming. One case in point is MECC, described earlier, which created the software to allow the micros to communicate with their Burroughs mainframes. Most support centers recommend that users purchase packages rather than program an application on their own.

In connection with this subject of "living with end user computers," two of the pioneers in automated office systems, Professor Howard Lee Morgan and Amy Wohl, are offering a new seminar on the subject—"Policy for the Personal Business Computer" (Reference 4). They believe that, with the entry of both IBM and Xerox into the personal business computer arena, larger organizations should no longer delay in developing corporate policies on this matter.

Conclusion. In many countries in the world today, it is almost impossible for the general public to *not* come in contact with computers in their daily lives. With this contact comes familiarity; and due to this familiarity, venturesome people are beginning to think about solving their business problems with their own computers. As we said earlier in this report, end user computers are probably inevitable. If such is indeed the case, it behooves information systems management to try to guide the trend rather than to fight it.

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COMMENTARY

WHAT IS HAPPENING WITH WORK-STATIONS?

We attend a number of computer-related conferences each year, not only to gain information from the technical sessions but also to identify developing trends in the field by touring the exhibit hall. At the recent AFIPS Office Automation Conference (OAC), held in San Francisco in April, we saw some interesting work-station developments that have reached fruition during the past year.

Integration of office functions. One theme dominated the OAC exhibit floor—the integration of office functions. Most of the office system exhibitors stressed that their systems were 'multi-functional.' And, in general, these systems appeared to perform much the same functions, judging from the menus we saw on their work-station display screens. These menus contained such items as electronic mail, calendar, data processing, business graphics, electronic spread sheet, file query, and word processing.

Such menus appeared to us to be the prevailing item at this year's exhibition. In the technical sessions of *last year's* OAC, the main theme was the desirability of the integration of functions for the work-station user. This year, we saw this integration of functions actually appear on the exhibit floor.

Specialized work-stations. We also saw an eye-catching example of a specialized work-station—in this instance, a managerial work-station. This was the Navigator management work-station from Grid Systems Corporation, of Mountain View, California. We will describe some of its characteristics, and then will give some of the features of the Xerox Star system, for a brief comparison of the two.

Grid's management work-station is portable, weighing just over nine pounds, and is somewhat larger than a metropolitan telephone directory when it is closed. It can be placed on a desk without being obtrusive, and can be carried in a briefcase. Its small size also makes it appear friendly and non-threatening. It contains Intel 8086 and 8087 micro-processors and has 256k bytes of RAM memory plus 256k bytes of bubble memory.

To use the work-station, the user flips up the front half of the lid to reveal a display screen in the top and a keyboard in the bottom section. The screen is a small but very readable flat display panel (not a bulky CRT). It can display up to 70 proportionally-spaced characters on each of 24 lines; by scrolling horizontally the user can view 256 characters or 256 columns. The keyboard has 57 full-size keys. The unit has a built-in modem, and the user can also connect a disk unit (floppy or hard) and a printer.

The total package contains five software programs of interest to management users: a data entry and query language, an electronic spread sheet package, a business graphics package, word processing, and a critical path program for generating project scheduling charts. These applications are menu-driven and use many of the same commands.

One gets the impression that executives who often resist using conventional terminals may accept a work-station of this type. It is small and compact. It gives a sense of privacy—for instance, cutting off the view by just closing the lid. Its price is just over $8,000, putting it in the not-for-just-anyone category.

Another approach to work-stations is represented by the Star work-station, introduced a year ago by Xerox Corporation. The Star was the first 'very different' office work-station to appear on the marketplace. It is said to be aimed more at professional office workers than at managers and executives. The Star is the size of a conventional display terminal. It is meant to be the primary 'workspace' of a professional office worker of the future, so it can take up more space on one's desk top. It is not meant to be portable.

The Star's display screen is about 10 inches by 13 inches in size, and can display two full pages of text side by side (at 96% of their printed size). The screen can be divided into six 'windows' to view six different pieces of work or documents at one time; also, each window can be scrolled individually both vertically and horizontally. The screen images are impressive, because of the high resolution employed (over 828,000 points, the equivalent of more than a 900-by-900 point raster). Further, the system contains graphic and typesetting software with a choice of print fonts and sizes.

Another unusual part of the Star system is the 'mouse,' used for controlling the cursor movement by rolling the mouse on the desk top. Two buttons on the mouse also allow users to select one or more items or objects that the cursor is pointing at.

Still another feature of the Star is its use of movable 'icons,' or little pictures, to represent individual documents, file folders, in-baskets, floppy disks, printers at local or remote locations, and such. One's screen can be full of these icons, each labeled with its own title. Moving an individual document icon to a specific printer icon, for instance, will cause that document to be printed on that particular printer.

This single-user system comes with a full-size keyboard and function keys, a hard disk unit storing 10 megabytes, and a floppy disk unit. The price of a basic Star is about $16,000.

These two systems represent new, innovative thinking concerning office work-stations; each has more depth and functionality than we have been able to describe here. They are products that are almost sure to encourage hands-on use of computers by managers, executives, and professional staff members.

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